

# HIV-Related Knowledge and Precautions among Michigan Nurses

## ABSTRACT

**Objectives.** The present study examined human immunodeficiency virus (HIV)-related knowledge and precautionary behaviors in a large random sample of registered nurses in all regions of the state of Michigan, allowing for comparisons among nurses in a wide range of occupational experiences, exposures, and backgrounds related to HIV.

**Methods.** A random sample of all registered nurses living in Michigan completed surveys in the fall of 1989.

**Results.** Although nearly all respondents indicated a high level of knowledge of known viable routes of HIV transmission, many respondents also reported misconceptions about several unverified nonviable routes of HIV transmission. Of the respondents who were involved in situations with potential risk of exposure to HIV, many failed to consistently use the universal precautions recommended by the Centers for Disease Control and Prevention. The respondents also reported significant barriers in applying infection control procedures.

**Conclusions.** The findings of the present study support the need for continued and intensified efforts to ensure that nurses have the knowledge necessary to provide quality care, are aware of the risk of potential exposures to HIV, and are engaging in appropriate precautionary behaviors. (*Am J Public Health.* 1993;83:1438-1442)

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## Introduction

The challenges of providing care for persons with human immunodeficiency virus (HIV) infection within the health care system have resulted in a number of concerns. Early studies have revealed that health care providers believe that their knowledge is insufficient to deal with the physical and emotional needs of their HIV-infected patients and have identified significant gaps in knowledge related to HIV among these professionals.<sup>1-6</sup>

Additionally, several studies indicate that many health care professionals perceive themselves to be at moderate or high risk of infection through occupational exposures.<sup>2,7-10</sup> Prospective studies, however, indicate that the actual risk of becoming infected through a needlestick is less than 1%, and the risk is even lower for other methods of exposure.<sup>11</sup> As of September 30, 1992, the Centers for Disease Control and Prevention (CDC) were aware of 32 documented cases of health care workers who seroconverted following occupational exposure to HIV and 69 undocumented cases of workers thought to be occupationally infected.<sup>12</sup>

In response to the potential for HIV transmission via occupational exposures, the CDC has recommended universal precautions to be used consistently in *all* procedures in which there is a possibility for contact with any patient's blood or body fluids. Researchers have demonstrated, however, that health care professionals are not consistently using universal precautions.<sup>13,14</sup>

Although past research has focused on health care workers in high-prevalence areas of HIV infection and on those actively involved in the care of HIV-infected patients, little attention has been paid to professionals working in low-prevalence areas or who have minimal contact with

HIV-infected individuals. The present study assesses HIV-related knowledge and precautionary behavior in a large random sample of registered nurses in all regions of the state of Michigan, allowing comparisons among nurses with a wide range of experiences, exposure, and backgrounds related to HIV.

The specific questions guiding this study were (1) What is the current level of registered nurses' knowledge regarding viable and nonviable routes of HIV transmission? (2) To what extent are nurses adhering to guidelines for universal precautions? and (3) What are the perceived barriers to using precautions? In addition, we examined how HIV-related knowledge and use of precautions varied as a function of practice setting, risk of occupational exposure to HIV, level of education, and characteristics of the geographic region where the nurses were practicing.

## Methods

### Survey Procedures

This study was conducted through Michigan's Department of Public Health, HIV/AIDS Prevention and Intervention Services, in the fall of 1989. Questionnaires were mailed to a random sample ( $n = 3468$ ) of all 80 289 licensed registered nurses living in Michigan. The sample of 3486 was reduced to 3083 after excluding the nondeliverable and incomplete surveys; 1777 nurses responded, represent-

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ing a response rate of 58%. The 247 nurses who reported that they were no longer practicing their profession were excluded, leaving a final sample of 1530.

### Sample Characteristics and Representativeness

To assess representativeness, we compared characteristics of the sample with 1988 population statistics available from the Michigan Department of Management and Budget.<sup>15</sup> Comparative data (Table 1) suggest that the sample was similar to the population of Michigan nurses but that middle-aged nurses and nurses with higher degrees were slightly overrepresented.

Almost all of the respondents (97%) were female. Respondents were employed in 69 of Michigan's 83 counties, but nearly 40% practiced in the greater Detroit area. The majority of nurses were providing direct patient care in either acute (51%) or nonacute (26%) settings.

### Survey Instrument

Successive drafts of the survey instrument were developed through the Michigan Department of Public Health in collaboration with the Michigan Nurses Association.

**HIV-Related Knowledge.** Four items assessed nurses' knowledge of the risk of infection through known viable routes of transmission and six items assessed knowledge of the risk of infection through nonviable routes of transmission. Viable routes are methods of transmission of HIV that have been officially documented through surveillance efforts.<sup>16,17</sup> Nonviable routes represent methods of transmission that, although they may be commonly perceived as possible means of transmission of HIV, have not been officially verified as actual routes of transmission. In addition, three items assessed knowledge of Michigan's HIV-related policies.

**Risk of Occupational Exposure to HIV.** A four-item scale was used to assess the nurses' occupational HIV exposure risk. Nurses reported whether, during the previous 3 months, they had (1) used needles when caring for a patient, (2) accidentally stuck themselves with a needle that had been used on a patient, (3) handled blood or body fluids or cared for a bleeding patient, or (4) attempted to resuscitate a patient.

**Use of Universal Precautions.** The subsample of nurses who reported activities that might have exposed them to patients' blood or other body fluids in the previous 3 months also reported their use of universal precautions when engaged in

these activities. Three precaution variables were used in this study. First, for those nurses who had used a needle in the previous 3 months, the survey assessed whether the nurses had recapped a needle. Recapping a needle was defined as putting the plastic cover in which the needle was packaged back on the needle after it had been used on a patient. To prevent needlestick injuries, universal precautions specify that needles should not be recapped.<sup>16</sup> Second, one item assessed whether or not the nurse had used a protective device when resuscitating a patient. Finally, for nurses who reported that they had handled blood or body fluids or they cared for a bleeding patient, five items assessed the consistency with which nurses wore protective gloves, wore protective gowns, wore protective shields (or eyewear), used bleach or disinfectant, and used puncture-resistant containers. Unlike the use of gloves or procedures for the disposal of needles that do not include recapping, the use of these precautions would depend on the potential for exposure to blood or body fluids in a specific care setting.

**Barriers to Using Universal Precautions.** The nurses indicated whether or not they felt the following were barriers to using protective gloves and other equipment: low availability of equipment, awkwardness in using equipment, poor sizing of equipment, poor quality of equipment, and other circumstances.

**Other Variables.** The respondents also reported their primary practice setting, their level of education, and the county in which they currently performed the majority of their nursing duties (county of employment). County of employment was used to create two geographical variables. Counties were categorized as either "Detroit counties" or "outstate counties" to allow for a comparison of nurses in a higher-prevalence area with those practicing in lower-prevalence areas. Counties were also characterized by specific numbers of reported AIDS cases.<sup>18</sup> Each Michigan county was then placed in one of six categories: (1) no reported cases, (2) 1 through 10 cases, (3) 11 through 20 cases, (4) 21 through 30 cases, (5) 31 through 50 cases, and (6) 51 through 500 cases. Each respondent was assigned a category value for her or his county of employment.

## Results

### Nurses' HIV-Related Knowledge

The nurses' responses to items assessing knowledge about the risk of HIV

**TABLE 1—Comparison of All Licensed Registered Nurses (RNs) in Michigan in 1988 and RNs Who Responded to the Survey (Sample): Percentages with Selected Characteristics**

	All RNs (n = 80 289)	Sample (95% CI) (n = 1530)
Age, y		
0–29	15	11 (9, 13)
30–39	35	39 (37, 41)
40–49	24	29 (27, 31)
≥50	26	21 (19, 23)
<b>Active RNs in 1988</b> (n = 65 049)		
Status		
Full-time <sup>a</sup>	65	64 (62, 66)
Part-time	35	36 (34, 38)
<b>Active RNs applying for renewal in 1988</b> (n = 34 828)		
Education		
High school diploma	36	34 (32, 36)
Associate degree	35	28 (26, 30)
BA/BS	25	30 (28, 32)
MA/PhD	4	8 (7, 9)

Note. The number of nurses used to compute the population statistics varied because of the limitations of data available from the state of Michigan. CI = confidence interval.

<sup>a</sup>Full-time status was defined as 35 or more hours/week for licensed RNs and 30 or more hours/week for RNs in the sample.

infection are listed in Table 2. Overall, respondents demonstrated a high level of knowledge regarding infection risks with the viable routes of HIV transmission. Nearly all respondents indicated correctly that HIV can be transmitted via needlestick, from large amounts of blood splashed on open sores or in the eyes, and from an infected pregnant woman to her baby.

Although this sample of nurses was knowledgeable about the viable routes of HIV transmission, many of the nurses demonstrated gaps in their knowledge about nonviable transmission routes. Substantial percentages of respondents failed to indicate the correct response for the following nonviable routes of HIV transmission: (1) being coughed or sneezed on; (2) resuscitating a patient with a protective device; (3) changing sheets on a patient's bed; (4) feeding a patient; (5) having skin-to-skin contact; and (6) being bitten by mosquitoes or other insects.

In response to items assessing knowledge of Michigan's HIV-related policies,

TABLE 2—Michigan Registered Nurses' Knowledge of HIV Transmission Risks through Viable and Nonviable Routes of Transmission

Route	Responses, %		
	Risk Present	No Risk Present	Don't Know
<b>Viable</b>			
Needlestick	99	<1	<1
Large amounts of blood splashed on open sores	99	<1	<1
Transmission from infected pregnant woman to baby	98	<1	1
Large amounts of blood splashed in the eye	97	<1	2
<b>Nonviable</b>			
Mosquito or other insect bites	13	58	29
Skin-to-skin contact (intact skin)	29	70	1
Changing sheets on a patient's bed	44	55	1
Feeding a patient	56	43	1
Providing mouth-to-mouth resuscitation with a protective device	74	24	2
Coughing or sneezing	80	18	2

Note. The percentages of correct responses are, with the "viable" routes, those in the "Risk Present" column and, with the "Nonviable" routes, those in the "No Risk Present" column. The sample sizes used to calculate percentages varied from 1492 to 1524 owing to missing data.

63% correctly reported that counseling on sexually transmitted diseases, including HIV infection, is mandatory in Michigan for marriage license applicants. About half (51%) of the respondents correctly reported that premarital testing for any sexually transmitted disease (including HIV infection) is *not* required by Michigan law; the same percentage of respondents were aware that free, anonymous testing for HIV is available in Michigan.

Respondents' mean item scores were calculated for each of the three measures of HIV-related knowledge. A multivariate analysis of variance (MANOVA) was employed to test whether nurses working in four different practice settings had different levels of HIV-related knowledge. A statistically significant MANOVA (Pillai's  $V = .03$ ; estimated  $F [9, 4392] = 5.63$ ,  $P < .001$ ;  $\eta^2 = .01$ ) revealed between-group differences among nurses in the different practice settings on the measures of HIV-related knowledge. An examination of the univariate ANOVA and post hoc comparison (listed in Table 3) revealed that nurses employed in acute care settings had significantly lower knowledge of nonviable routes of transmission and Michigan HIV-related policies than did nurses employed in other practice settings.

There were no significant between-group differences in HIV-related knowledge between nurses practicing in the Detroit area and those in the rest of the state, between nurses practicing in different geographical prevalence areas, or be-

tween nurses with different levels of education.

### Use of Universal Precautions

Of the nurses who were exposed to blood or body fluids in the previous 3 months, a considerable number indicated that they infrequently used universal precautions (see Table 4). Over one fourth of the sample reported that they did not use gloves every time they handled patients' blood or body fluids or cared for a bleeding patient.

Respondents were also asked to indicate the frequency of use of other precautions under these conditions involving exposure to blood and other body fluids. Although the use of these precautions would be dependent on the conditions involved in specific care settings, it is noteworthy that the majority of nurses reported never using protective eyewear and gowns. In contrast, nearly all respondents reported almost always using puncture-resistant containers for the disposal of needles and other sharp instruments.

Of those who used needles when treating patients, more than half of the nurses had failed to follow the recommended procedure of not recapping needles at least once in the previous 3 months. More than 1 out of 10 nurses reported sticking themselves with a needle that had been used on a patient. It is not known how many of these reported needlestick injuries were a consequence of recapping a used needle. Recapping needles, how-

ever, was related to needlesticks: 10% of the respondents who reported recapping a needle also reported a needlestick, whereas only 3% of those who avoided needle recapping reported a needlestick ( $\chi^2 = 20.56$ ,  $P < .001$ , 95% CI = .01, .13).

Of the nurses who reported that they had attempted to resuscitate a patient in the previous 3 months ( $n = 341$ ), most (96%) reported correctly using a protective device.

Although a considerable number of nurses appeared to be inconsistent in their use of HIV infection precautions in their work, only 41 respondents from the entire sample ( $n = 1530$ ) reported that they had ever requested HIV antibody testing because they believed they had been accidentally exposed to HIV on the job. Among nurses who reported the use of needles, needlesticks were closely related to requests for HIV antibody testing: 13% of nurses who reported a needlestick requested testing, whereas only 2% of those who did not report a needlestick requested testing ( $\chi^2 = 58.43$ ,  $P < .001$ , 95% CI = .04, .18).

An analysis of variance reveals significant differences in the indices of precaution use for nurses handling blood or body fluids ( $F [3, 1246] = 32.01$ ,  $P < .001$ ,  $\eta^2 = .27$ ) and using a needle ( $F [3, 1284] = 5.97$ ,  $P < .001$ ,  $\eta^2 = .01$ ) by the different practice settings. Post hoc multiple comparison analyses (Newman-Keuls) revealed that (1) nurses working in acute care settings were more likely to use precautions when handling blood or body fluids than were nurses working in nonacute care, administrative, and educational settings, and (2) nurses working in acute care and nonacute care settings were more likely to recap a needle than were nurses who typically worked in administrative settings.

There were no significant between-group differences in precaution use between nurses in the Detroit area and those in the rest of the state, between the different geographical prevalence areas, or between different levels of education.

The correlations between the risk of occupational exposure to HIV and the use of precautions were small but statistically significant. Nurses who scored higher on the measure of occupational exposure risk were more likely to use precautions when handling blood or body fluids or caring for a bleeding patient ( $r = .11$ ,  $P < .01$ ,  $n = 1288$ ) and less likely to utilize precautions when using a needle ( $r = -.12$ ,  $P < .01$ ,  $n = 1248$ ).

TABLE 3—Comparison of Scores on HIV-Related Knowledge Measures for Nurses in Four Practice Settings

HIV-Related Knowledge Measure	Practice Setting Group								F (3,1464)	Newman-Keuls Comparison	$\eta^2$
	1		2		3		4				
	Acute (n = 791)		Nonacute (n = 433)		Administrative (n = 175)		Educational (n = 69)				
	Mean	SD	Mean	SD	Mean	SD	Mean	SD			
Viable routes of transmission	1.99	.05	1.98	.08	1.99	.05	1.99	.04	2.64	...	...
Nonviable routes of transmission	1.39	.24	1.45	.26	1.46	.27	1.51	.24	9.15*	1 < 2, 3, 4	.018
Michigan HIV-related policies	1.52	.31	1.57	.32	1.60	.29	1.61	.31	6.31*	1 < 2, 3	.012
<i>Note.</i> n = 1468 because of missing data.											
*P < .01.											

Note. n = 1468 because of missing data.

\*P < .01.

### Barriers to Using Universal Precautions

Respondents reported significant barriers that make it more difficult to use protective measures. They indicated that gloves and other protective equipment were awkward (54%), poorly constructed (42%), and not readily available (14%) and that gloves were not the right size (34%). Other barriers cited were lack of time in emergency situations and interference with the performance of nursing duties.

### Discussion

The present study revealed that although most of the registered nurses surveyed were able to correctly identify the major routes of HIV transmission, many misconceptions about nonviable means of HIV transmission persist. Perhaps the most disturbing finding of this study was that nurses in acute care settings—those who deliver a greater proportion of direct health care—gave more incorrect answers on the HIV-knowledge questions. It is also worth noting that nurses working in high prevalence areas or in counties with higher numbers of reported cases of AIDS did not have significantly higher levels of HIV-related knowledge.

This study also identifies a critical need to address the issues surrounding precautionary behaviors. Findings include the following: (1) nearly all of the nurses surveyed indicated exposure to biologic materials that have potential for HIV transmission; (2) more than 40% had recapped a needle in the previous 3 months; (3) 12% of the nurses had actually stuck themselves with a needle that had been used on a patient; and (4) 30% of the nurses reported the inconsistent use of gloves.

Not only did nurses working in acute care settings (those most likely to encoun-

TABLE 4—Use of HIV-Preventive Precautions <sup>a</sup> among Michigan Nurses Who Handle Blood or Body Fluids (n = 1264) or Use Needles (n = 1304)			
	Response, %		
	Almost always	Sometimes	Almost never
When handling blood or body fluids or caring for a bleeding patient in the past 3 months, how often did you			
Wear protective gloves?	71	23	6
Wear a protective gown?	8	33	59
Wear a protective shield or eyewear?	19	17	65
Use bleach or disinfectant?	46	13	41
Use puncture-resistant containers?	90	5	5
	Yes		No
When using a needle in the past 3 months, did you			
Recap a used needle?	61		39
Stick yourself with a needle?	13		87

<sup>a</sup>Recommended by the Centers for Disease Control and Prevention.

ter HIV-infected patients) demonstrate the lowest levels of HIV-related knowledge; they were also more likely to have recapped a needle in the previous 3 months. It is heartening, however, to note that these nurses were the ones who most consistently followed the recommended precautions when handling blood or body fluids.

Two methodological concerns indicate the need for a cautious approach to interpreting and generalizing the results of this study. The nurses who responded to the survey represented only 58% of those sampled. The data available on the entire population of nurses suggests that the present sample was reasonably representative. Nonetheless, it is possible that the nurses who returned completed surveys represented a slightly different cross-section of the nursing population.

A second concern is the present study's reliance on self-report procedures. Knowledge and practices surrounding

HIV infection are still highly sensitive and controversial in many communities. Despite the anonymity of the survey, participants in these types of studies may feel pressured to provide socially acceptable responses. Future studies should employ multiple methods of assessment such as behavioral observations, reports from coworkers and patients, archival data, and daily logs.

### Policy Implications

These results suggest the need for further training to address the current misconceptions and misinformation regarding HIV infection. Although all nurses need basic information and training related to HIV infection, the results of the present study support the need for intensified and specialized efforts to address the concerns of nurses in acute care settings.

The nurses' inconsistent use of occupational safety procedures illustrates the

urgent need to ensure that nurses are aware of the risk of potential exposure to HIV and are properly applying universal precautions. The importance of addressing barriers to the use of precautions is also evident. Although the majority of respondents were aware of and in agreement with policies regarding universal precautions in their workplaces, many respondents indicated barriers that prevented the effective use of precautions. Efforts to increase the use of universal precautions among health care professionals must address these barriers.

The issues surrounding occupational exposures with potential for the transmission of HIV must also be addressed. Only a small number of nurses in the present study had requested antibody testing following a potential exposure to HIV, and the majority of nurses who reported accidental needlesticks did not request antibody testing. Further research is warranted to identify the environmental and human factors that affect occupational exposures to HIV and determine whether or not health care professionals request HIV antibody testing following these exposures.

The findings of the present study, along with previous research, justify the need for continued and increased efforts to address the needs of all health care professionals. The spread of the AIDS epidemic and its growing impact on our health care system underscore the urgency of addressing these needs. These efforts will be vital in ensuring quality levels of care to persons at all stages of HIV infection and in ensuring environments that will provide the necessary levels of

support and resources to health care workers. □

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